ANALYSIS OF WATER PROFILE AT THE BUKIT KUANG BRIDGE, KEMAMAN

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Pembangunan yang pesat berlaku berhampiran kawasan sungai telah mengakibatkan peningkatan permintaan infrastruktur sungai seperti jambatan. Jambatan baru yang dikenali sebagai Jambatan Bukit Kuang telah dibina menyeberangi Sungai Chukai dan telah dibuka pada tahun 2014. Ia penting untuk memahami ciri hidrologi dan hidraulik sungai untuk memastikan kecekapan reka bentuk jambatan dan keselamatannya. Analisis profil air telah dijalankan untuk menentukan paras air di antara dua keadaan iaitu jambatan lama dan jambatan baru. Jambatan lama mempunyai sepuluh tiang manakala untuk jambatan baru mempunyai dua tiang. Simulasi menggunakan data hujan 2013 hingga 2018 sebagai input kepada HEC-HMS menghasilkan aliran puncak dan hidrograf untuk ARI 5 tahun, 10 tahun, 20 tahun, 50 tahun dan 100 tahun. Hasil simulasi HEC-HMS digunakan di HEC-RAS untuk menentukan profil air untuk 2,700 meter sebelum dan selepas lokasi jambatan jambatan. Dari analisis di jambatan baru, paras air di ARI 100 tahun tidak akan melimpah di sepanjang sungai kerana kedalaman sungai ini telah dikorek untuk membolehkan kapal-kapal lalu.

ABSTRACT

Massive development occurs near the river area which resulted in increase in demand of river infrastructure such as bridge. A new replacement bridge crossing the Chukai River called the Bukit Kuang Bridge, Kemaman was opened on 2014. It is important to understand about the hydrology and hydraulic characteristic of the river to ensure the efficiency of the bridge's design and its safety. Analysis of water profiles were carried out to determine the water levels at the old bridge piers and the new bridge piers. The old bridge had ten piers while for the new bridge has two piers. The new replacement bridge was design to allow ships to pass through. Simulation using the 2013 to 2018 rainfall data as input to HEC-HMS produced peak flows and hydrographs for 5-year, 10-year, 20-year, 50-year and 100-year ARI. Output of HEC-HMS were used in HEC-RAS to determine the water profile for 2,700 meter before and after the bridge piers location. From the analysis at the new bridge piers, the water level at 100-year ARI shall not overflow along the river since the river was deepen to allow ships passing through.

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LIST OF SYMBOLS

A	Catchment area
B	Top width
C	Runoff coefficient
d	Depth
I	Rainfall intensity
L	Main stream length
N	Manning roughness coefficient
P	Wetted perimeter
Q	Flow rate
Q_b	Baseflow
R	Catchment storage coefficient
S	Weighted slope of main stream
T	Time
T_c	Time of concentration
V	Velocity

LIST OF ABBREVIATIONS

ARI	Annual recurrence interval
cfs	Cubic feet per second
CH	Chainage
CMSB	Cergas Murni Sdn. Bhd.
DID	Department of Irrigation and Drainage
JUPEM	Department of Survey and Mapping Malaysia
m/s	Meter per second
m^3/s	Cubic meter per second
MACRES	Malaysia Remote Sensing Agency
MSMA	Urban Stormwater Management Manual for Malaysia

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Floods are natural phenomena. Floods are temporary overflow of a normally dry area due to overflow of a body of water, unusual build up, runoff of surface waters, or abnormal erosion or undermining of shoreline (Ostria, 2018). It causes the most damage to infrastructure compared to any other natural hazards in the world. Flood loss prevention and mitigation includes structural flood control measures such as construction of dams or river dikes and non-structural measures such as flood forecasting and warning, flood hazard and risk management, public participation and institutional arrangement (Tingsanchali, 2012). Bridge structures located over waterways are prone to failure under flood events. Failure of a bridge can impact on the community significantly by reducing the evacuation capability and recovery operations during and after a disaster.

However, all floods are not alike. There are a few types of floods such as surge flood, river flood and surface flood (Maddox, 2014). Some floods develop slowly, sometimes over a period of days. But, flash floods can develop quickly, sometimes in just a few minutes and without any visible sign of rain (Maddox, 2014). The damage from a river flood can be widespread as the overflow affects smaller rivers downstream, often causing dams and dikes to break and swamp nearby areas. This research presents the results of an investigation into flood estimation on the Chukai River, Kemaman as shown in Figure 1.1.

Figure 1.1 Chukai River (LLC, 2005)

1.2 PROBLEM STATEMENT

Malaysia is experiencing two monsoonal seasons, which have induced heavy rainfall. The increasing of rainfall intensity and longer duration of rainfall has caused a flood. Southeast Asia has long experienced a monsoon climate with dry and wet seasons. With mean annual rainfall precipitation locally in excess of 5,000 mm, the very intense rainstorms in the steep mountains of Malaysia have caused frequent and devastating flash floods (Julien, 2018).

Floods often occur in a developed area. This is because the rain would be absorbed in areas that are not developed compared to the developed area. As a result, if a huge sum of rain within the created range, as it were a small is retained into the ground and the rest will be water run-off and stream to the lower zone. In order to prevent this flood from occurring, the study should be carry out to predict the flood. Flood warning systems should be made to predict the occurrence of flood.

Generally, a great majority of bridges are built across rivers and routinely the water flow force on the pier is calculated using the methods specified in the design codes (Yin-Hui Wang, 2014). The development or renovation of bridges may require placement of bridge piers within the channel or floodplain of natural waterways. These piers would obstruct the flow and cause an increase in water levels backwater upstream of the bridge for subcritical flows (Randall J. Charbeneau, 2001). The sum of backwater caused by piers depends mainly on their geometric shape, their position within the stream, the stream rate, and the sum of channel blockage.

Bukit Kuang Bridge is the replacement bridge on Chukai River near Chukai, Kemaman, Terengganu. It is one of the bridge construction projects with a new four-lane carriageway with new vertical clearance to allow the ships to pass through.

Figure 1.2 illustrates the Bukit Kuang Bridge located across Chukai River where bridge piers act as the structural element.

Figure 1.2 Bukit Kuang Bridge, Kemaman, Terengganu

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